

## **AMENDMENTS TO THE CLAIMS**

The following listing of claims will replace all prior versions and listings of claims in the application.

### **LISTING OF CLAIMS**

1-15. (cancelled)

16. (previously presented) A Video-on Demand client system to prefetch segments of video data streams through multiple communications channels of data-centered broadcasting network from a video data server for implementing VCR functions including at least playback the segments, said client system comprising:

at least one loader to download the segments of the video stream from the video data server;

at least one buffer to store the downloaded segments from said loader;

a player to playback the segments read from said buffer, said player being responsive to VCR function commands given through user-interface thereof;

a playback pointer to issue playback commands to said player for designating a playback starting point of the segment in said buffer; and

a prefetch manager to issue prefetch commands to said loader for prefetching the segments from the server based on the current playback point of the segment in said buffer so as to keep the playback point designated by said pointer within predetermined range of said buffer,

wherein according to size of the broadcasting segment through the channels of the network from the server to the client, said playback pointer designates the feasible playback starting point for a destination frame point  $p$  of the segment designated by VCR function commands,

where

- $k$  is defined as natural number;
- $b(k)$  is defined as a beginning frame point of segment No.  $k$ ;
- $e(k)$  is defined as an end frame point of segment No.  $k$ ;
- $c(k)$  is defined as a current broadcasting frame point of segment No.  $k$ ;
- $K$  is defined as numbers of channels and divided into segments of a set

of video data streams of each video of length;

- point value of  $b(k)$  equals to 0,  $(1 \leq k \leq K)$ ;
- condition (a): the destination point  $p$  is located at or before broadcasting point  $c(k)$  of the segment  $k$  broadcasting in channel  $k$ ; and
  - condition (b): the size of the current broadcasting segment  $k$  equals to the size of next segment  $k+1$ ,

wherein

when the conditions (a) and (b) are satisfied, if frames between the destination point  $p$  and  $c(k)$  are in the buffer, then the point  $p$  is the feasible point, otherwise the later nearest point  $q$  that frames between points of  $q$  and  $c(k)$  are in the buffer is the feasible point having smallest point value.

17. (previously presented) A Video-on Demand client system to prefetch segments of video data streams through multiple communications channels of data-centered broadcasting network from a video data server for implementing VCR functions including at least playback the segments, said client system comprising:

at least one loader to download the segments of the video stream from the video data server;

at least one buffer to store the downloaded segments from said loader;

a player to playback the segments read from said buffer, said player being responsive to VCR function commands given through user-interface thereof;

a playback pointer to issue playback commands to said player for designating a playback starting point of the segment in said buffer; and

a prefetch manager to issue prefetch commands to said loader for prefetching the segments from the server based on the current playback point of the segment in said buffer so as to keep the playback point designated by said pointer within predetermined range of said buffer,

wherein according to size of the broadcasting segment through the channels of the network from the server to the client, said playback pointer designates the feasible playback starting point for a destination frame point p of the segment designated by VCR function commands,

where

- k is defined as natural number;
- b(k) is defined as a beginning frame point of segment No. k;
- e(k) is defined as an end frame point of segment No. k;

- $c(k)$  is defined as a current broadcasting frame point of segment No.  $k$ ;
- $K$  is defined as numbers of channels and divided into segments of a set of video data streams of each video of length;
  - point value of  $b(k)$  equals to 0 as an offset value, ( $1 \leq k \leq K$ );
  - condition (a): the destination point  $p$  is located at or before broadcasting point  $c(k)$  of the segment  $k$  broadcasting in channel  $k$ ;
  - condition (c): the size of the current broadcasting segment  $k$  is half of size of the next segment  $k+1$  and the size of the next two segments  $k+1$  and  $k+2$ ; and
  - condition (d): the point value of  $c(k)$  equals to the point value of  $c(k+1)$ ,

wherein

when the conditions (a), (c) and (d) are satisfied,

if both frames between the destination point  $p$  and  $c(k)$  and frames between the point  $b(k+1)$  and  $c(k+1)$  are in the buffer, then the point  $p$  is the feasible point,

otherwise:

if frames between the points of  $b(k+1)$  and  $c(k+1)$  are in the buffer, then the later nearest point  $q$  that frames between  $q$  and  $c(k)$  is in the buffer is the feasible point having smallest point value,

if frames between the points of  $b(k+1)$  and  $c(k+1)$  are not in the buffer, then the later nearest point  $q$  that frames between the points  $q$  and  $c(k+1)$  is in the buffer are the feasible point having smallest point value.

18. (previously presented) A Video-on Demand client system to prefetch segments of video data streams through multiple communications channels of data-centered broadcasting network from a video data server for implementing VCR functions including at least playback the segments, said client system comprising:

at least one loader to download the segments of the video stream from the video data server;

at least one buffer to store the downloaded segments from said loader;

a player to playback the segments read from said buffer, said player being responsive to VCR function commands given through user-interface thereof;

a playback pointer to issue playback commands to said player for designating a playback starting point of the segment in said buffer; and

a prefetch manager to issue prefetch commands to said loader for prefetching the segments from the server based on the current playback point of the segment in said buffer so as to keep the playback point designated by said pointer within predetermined range of said buffer,

wherein according to size of the broadcasting segment through the channels of the network from the server to the client, said playback pointer designates the feasible playback starting point for a destination frame point p of the segment designated by VCR function commands,

where

- k is defined as natural number;
- b(k) is defined as a beginning frame point of segment No. k;
- e(k) is defined as an end frame point of segment No. k;

- $c(k)$  is defined as a current broadcasting frame point of segment No.  $k$ ;
- $K$  is defined as numbers of channels and divided into segments of a set of video data streams of each video of length;
  - point value of  $b(k)$  equals to 0 as an offset value, ( $1 \leq k \leq K$ );
  - condition (a): the destination point  $p$  is located at or before broadcasting point  $c(k)$  of the segment  $k$  broadcasting in channel  $k$ ;
  - condition (c): the size of the current broadcasting segment  $k$  is half of size of the next segment  $k+1$  and the size of the next two segments  $k+1$  and  $k+2$ ; and
  - condition (e): the point value of  $c(k)$  does not equals to the point value of  $c(k+1)$ ,

wherein

- when the conditions (a), (c) and (e) are satisfied,
  - if both frames between the destination point  $p$  and  $c(k)$  are in the buffer, then the point  $p$  is the feasible point,
  - otherwise the later nearest point  $q$  that frames between points of  $q$  and  $c(k)$  are in the buffer is the feasible point having smallest point value.

19. (previously presented) A Video-on Demand client system to prefetch segments of video data streams through multiple communications channels of data-centered broadcasting network from a video data server for implementing VCR functions including at least playback the segments, said client system comprising:

- at least one loader to download the segments of the video stream from the video data server;

at least one buffer to store the downloaded segments from said loader;  
a player to playback the segments read from said buffer, said player being responsive to VCR function commands given through user-interface thereof;  
a playback pointer to issue playback commands to said player for designating a playback starting point of the segment in said buffer; and  
a prefetch manager to issue prefetch commands to said loader for prefetching the segments from the server based on the current playback point of the segment in said buffer so as to keep the playback point designated by said pointer within predetermined range of said buffer,

wherein according to size of the broadcasting segment through the channels of the network from the server to the client, said playback pointer designates the feasible playback starting point for a destination frame point p of the segment designated by VCR function commands,

where

- k is defined as natural number;
- b(k) is defined as a beginning frame point of segment No. k;
- e(k) is defined as an end frame point of segment No. k;
- c(k) is defined as a current broadcasting frame point of segment No. k;
- K is defined as numbers of channels and divided into segments of a set of video data streams of each video of length;
  - point value of b(k) equals to 0 as an offset value, ( $1 \leq k \leq K$ );
  - condition (a): the destination point p is located at or before broadcasting point c(k) of the segment k broadcasting in channel k;

- condition (f): the size of the current broadcasting segment  $k$  is half of size of the next segment  $k+1$  and the size of the next segments  $k+1$  is half of size of its next segment  $k+2$ ; and

- condition (g): the point value of  $c(k)$  equals to the both point values of  $c(k+1)$  and  $c(k+2)$ ,

wherein

when the conditions (a), (f) and (g) are satisfied,

if frames between the destination point  $p$  and  $c(k)$ , frames between the point  $b(k+1)$  and  $c(k+1)$ , and frames between the point  $b(k+2)$  and  $c(k+2)$  are in the buffer, then the point  $p$  is the feasible point,

otherwise:

if frames between the point  $b(k+1)$  and  $c(k+1)$ , and frames between the point  $b(k+2)$  and  $c(k+2)$  are in the buffer, then the later nearest point  $q$  that frames between  $q$  and  $c(k)$  is in the buffer is the feasible point having smallest point value,

if frames between the points of  $b(k+1)$  and  $c(k+1)$  are not all in the buffer, and frames between the point  $b(k+2)$  and  $c(k+2)$  are in the buffer, then the later nearest point  $q$  that frames between  $q$  and  $c(k+1)$  is in the buffer is the feasible point having smallest point value,

if frames between the points of  $b(k+1)$  and  $c(k+1)$  are not in the buffer, then the later nearest point  $q$  that frames between the points  $q$  and  $c(k+2)$  are in the buffer is the feasible point having smallest point value.

20. (previously presented) A Video-on Demand client system to prefetch segments of video data streams through multiple communications channels of data-centered broadcasting network from a video data server for implementing VCR functions including at least playback the segments, said client system comprising:

at least one loader to download the segments of the video stream from the video data server;

at least one buffer to store the downloaded segments from said loader;

a player to playback the segments read from said buffer, said player being responsive to VCR function commands given through user-interface thereof;

a playback pointer to issue playback commands to said player for designating a playback starting point of the segment in said buffer; and

a prefetch manager to issue prefetch commands to said loader for prefetching the segments from the server based on the current playback point of the segment in said buffer so as to keep the playback point designated by said pointer within predetermined range of said buffer,

wherein according to size of the broadcasting segment through the channels of the network from the server to the client, said playback pointer designates the feasible playback starting point for a destination frame point  $p$  of the segment designated by VCR function commands,

where

- $k$  is defined as natural number;
- $b(k)$  is defined as a beginning frame point of segment No.  $k$ ;
- $e(k)$  is defined as an end frame point of segment No.  $k$ ;

- $c(k)$  is defined as a current broadcasting frame point of segment No.  $k$ ;
- $K$  is defined as numbers of channels and divided into segments of a set of video data streams of each video of length;
  - point value of  $b(k)$  equals to 0 as an offset value, ( $1 \leq k \leq K$ );
  - condition (a): the destination point  $p$  is located at or before broadcasting point  $c(k)$  of the segment  $k$  broadcasting in channel  $k$ ;
    - condition (f): the size of the current broadcasting segment  $k$  is half of size of the next segment  $k+1$  and the size of the next segments  $k+1$  is half of size of its next segment  $k+2$ ; and
    - condition (h): the point value of  $c(k)$  equals the point value of  $c(k+1)$  and does not equal  $c(k+2)$ ,

wherein

- when the conditions (a), (f) and (h) are satisfied,
  - if frames between the destination point  $p$  and  $c(k)$ , and frames between the point  $b(k+1)$  and  $c(k+1)$  are in the buffer, then the point  $p$  is the feasible point, otherwise:
    - if frames between the point  $b(k+1)$  and  $c(k+1)$  are in the buffer, then the later nearest point  $q$  that frames between  $q$  and  $c(k)$  is in the buffer is the feasible point having smallest point value,
    - if frames between the points of  $b(k+1)$  and  $c(k+1)$  are not all in the buffer, then the later nearest point  $q$  that frames between  $q$  and  $c(k+1)$  is in the buffer is the feasible point having smallest point value.

21. (previously presented) A Video-on Demand client system to prefetch segments of video data streams through multiple communications channels of data-centered broadcasting network from a video data server for implementing VCR functions including at least playback the segments, said client system comprising:

at least one loader to download the segments of the video stream from the video data server;

at least one buffer to store the downloaded segments from said loader;

a player to playback the segments read from said buffer, said player being responsive to VCR function commands given through user-interface thereof;

a playback pointer to issue playback commands to said player for designating a playback starting point of the segment in said buffer; and

a prefetch manager to issue prefetch commands to said loader for prefetching the segments from the server based on the current playback point of the segment in said buffer so as to keep the playback point designated by said pointer within predetermined range of said buffer,

wherein according to size of the broadcasting segment through the channels of the network from the server to the client, said playback pointer designates the feasible playback starting point for a destination frame point p of the segment designated by VCR function commands,

where

- k is defined as natural number;
- b(k) is defined as a beginning frame point of segment No. k;
- e(k) is defined as an end frame point of segment No. k;

- $c(k)$  is defined as a current broadcasting frame point of segment No.  $k$ ;
- $K$  is defined as numbers of channels and divided into segments of a set of video data streams of each video of length;
- point value of  $b(k)$  equals to 0 as an offset value,  $(1 \leq k \leq K)$ ;
- condition (a): the destination point  $p$  is located at or before broadcasting point  $c(k)$  of the segment  $k$  broadcasting in channel  $k$ ;
  - condition (f): the size of the current broadcasting segment  $k$  is half of size of the next segment  $k+1$  and the size of the next segments  $k+1$  is half of size of its next segment  $k+2$ ; and
    - condition (i): the point value of  $c(k)$  equals to the point values of  $c(k+2)$  and does not equal to  $c(k+1)$ ,

wherein

- when the conditions (a), (f) and (i) are satisfied,
- if frames between the destination point  $p$  and  $c(k)$ , and frames between the point  $b(k+2)$  and  $c(k+2)$  are in the buffer, then the point  $p$  is the feasible point,
- otherwise:
  - if frames between the point  $b(k+2)$  and  $c(k+2)$  are in the buffer, then the later nearest point  $q$  that frames between  $q$  and  $c(k)$  is in the buffer is the feasible point having smallest point value,
  - if frames between the points of  $b(k+2)$  and  $c(k+2)$  are not all in the buffer, then the later nearest point  $q$  that frames between  $q$  and  $c(k+2)$  is in the buffer is the feasible point having smallest point value.

22. (previously presented) A Video-on Demand client system to prefetch segments of video data streams through multiple communications channels of data-centered broadcasting network from a video data server for implementing VCR functions including at least playback the segments, said client system comprising:

at least one loader to download the segments of the video stream from the video data server;

at least one buffer to store the downloaded segments from said loader;

a player to playback the segments read from said buffer, said player being responsive to VCR function commands given through user-interface thereof;

a playback pointer to issue playback commands to said player for designating a playback starting point of the segment in said buffer; and

a prefetch manager to issue prefetch commands to said loader for prefetching the segments from the server based on the current playback point of the segment in said buffer so as to keep the playback point designated by said pointer within predetermined range of said buffer,

wherein according to size of the broadcasting segment through the channels of the network from the server to the client, said playback pointer designates the feasible playback starting point for a destination frame point p of the segment designated by VCR function commands,

where

- k is defined as natural number;
- b(k) is defined as a beginning frame point of segment No. k;
- e(k) is defined as an end frame point of segment No. k;

- $c(k)$  is defined as a current broadcasting frame point of segment No.  $k$ ;
- $K$  is defined as numbers of channels and divided into segments of a set of video data streams of each video of length;
  - point value of  $b(k)$  equals to 0 as an offset value,  $(1 \leq k \leq K)$ ;
  - condition (a): the destination point  $p$  is located at or before broadcasting point  $c(k)$  of the segment  $k$  broadcasting in channel  $k$ ;
  - condition (f): the size of the current broadcasting segment  $k$  is half of size of the next segment  $k+1$  and the size of the next segments  $k+1$  is half of size of its next segment  $k+2$ ; and
    - condition (j): the point value of  $c(k)$  does not equal to the both point values of  $c(k+1)$  and  $c(k+2)$ ,

wherein

when the conditions (a), (f) and (j) are satisfied,

if frames between the destination point  $p$  and  $c(k)$  are in the buffer, then the point  $p$  is the feasible point,

otherwise the later nearest point  $q$  that frames between  $q$  and  $c(k)$  is in the buffer is the feasible point having smallest point value.

23. (previously presented) A Video-on Demand client system to prefetch segments of video data streams through multiple communications channels of data-centered broadcasting network from a video data server for implementing VCR functions including at least playback the segments, said client system comprising:

at least one loader to download the segments of the video stream from the video data server;

at least one buffer to store the downloaded segments from said loader;

a player to playback the segments read from said buffer, said player being responsive to VCR function commands given through user-interface thereof;

a playback pointer to issue playback commands to said player for designating a playback starting point of the segment in said buffer; and

a prefetch manager to issue prefetch commands to said loader for prefetching the segments from the server based on the current playback point of the segment in said buffer so as to keep the playback point designated by said pointer within predetermined range of said buffer,

wherein according to size of the broadcasting segment through the channels of the network from the server to the client, said playback pointer designates the feasible playback starting point for a destination frame point p of the segment designated by VCR function commands,

where

- k is defined as natural number;
- b(k) is defined as a beginning frame point of segment No. k;
- e(k) is defined as an end frame point of segment No. k;
- c(k) is defined as a current broadcasting frame point of segment No. k;
- K is defined as numbers of channels and divided into segments of a set of video data streams of each video of length;
- point value of b(k) equals to 0 as an offset value, ( $1 \leq k \leq K$ );

- condition (k): the destination point p is located after the current broadcasting point c (k) of the segment k broadcasting in channel k,  
wherein

when the condition (k) is satisfied, frames between the destination point p and c(k) are considered as frames between p and e(k-1) and frames between b(k) and c(k) so that the destination point p is considered to be located at or before broadcasting point c(k) of the segment k broadcasting in channel k.

24-31. (cancelled)